

REMARKS

Claims 1-3, 5-15, 17-18 and 38-45 are pending in the application. The undersigned thanks the Examiner for her time and courtesy in conducting a telephonic conference with Applicant's attorneys on January 30, 2002. After discussing the amended claims in light of the references cited by the Examiner, the Examiner agreed that the claims as presented in Applicant's Response Under 37 C.F.R. § 1.116 dated January 31, 2002 would distinguish over the art of record. The Examiner further stated that if no more pertinent art is found in an updated search, the amended claims would be allowable. On February 15, 2002, the Examiner issued an Advisory Action noting that the amendments discussed during the interview on January 30, 2002 would not be entered in light of U.S. Patent No. 5,960,260 to Umehara *et al.*

In order to help the Examiner appreciate certain distinctions between the pending claims and the subject matter of the applied references, the disclosed embodiments of the invention will now be discussed in comparison to the applied reference. Specific distinctions between the pending claims and the applied reference will be discussed after the discussion of the disclosed embodiments and the applied reference. The discussion of the difference between the disclosed embodiment and the applied reference does not define the scope or interpretation of any of the claims.

Embodiments of the present invention are directed to a semiconductor package assembly having a plurality of pieces of compliant adhesive film to adhere a BGA-type semiconductor die to an organic substrate or polyimide substrate interposer. The plurality of pieces of compliant adhesive film reduces failures in BGA-package solder bonds caused by shearing forces resulting from unmatched thermal expansion rates of the interposer and the semiconductor die. The specification further describes that the cumulative thermal expansion for the multiple pieces of adhesive film is less than the thermal expansion for a single layer of elastomer film. As a result, the stress on the BGA-package wire bond joints resulting from the different coefficients of thermal expansion between the die and the substrate are reduced.

The plurality of pieces of compliant adhesive film employed within a semiconductor package taught by Applicant, and the attendant problems addressed by the plurality of pieces of compliant adhesive film, are different from the problems addressed in Umehara. Specifically, Umehara discloses a lead frame package (*e.g.* Figs. 1 and 3) having an uncoated semiconductor die 10 attached by adhesive strips to an alloy mounting pad 81. Following attachment of the die 10 to the alloy mounting pad 81, the package is encased in an

encapsulant 16. Umehara does not disclose semiconductor device package having a die attached to an organic or polyimide interposer. Nor does Umehara teach or suggest that its strips may be used to adhere a die to an organic or polyimide interposer to reduce stress at wire bond joints in semiconductor packages.

Turning now to the claims, claim 1 recites a semiconductor device package, comprising a semiconductor die having a first surface on which an integrated circuit and at least one electrically conductive bond pad are fabricated, the die having first and second pairs of opposed lateral edges; at least one electrically conductive external terminal; an interposer having a die attach surface and an external surface opposite of the die attach surface disposed in between the semiconductor die and the at least one external terminal, *the interposer having at least one electrically conductive interconnect electrically coupling the at least one bond pad of the semiconductor die positioned adjacent to the die attach surface to the at least external terminal positioned adjacent to the external surface, the interposer being formed of an organic substrate or a polyimide substrate*; and a plurality of strips of compliant adhesive film extending substantially the entire distance between the first pair of opposed lateral edges disposed in between the semiconductor die and the interposer to adhere the semiconductor die to the die attach surface of the interposer, the strips of compliant adhesive film each extending substantially less than the distance between the second pair of opposed lateral edges.

Claim 11 recites a device package assembly for a semiconductor die being constructed from a process comprising laminating a plurality of strips of compliant adhesive film to an interposer having at least one electrically conductive interconnect, *the interposer being formed of an organic substrate or a polyimide substrate* and further having a die attach surface to which the semiconductor die is attached, and an external surface opposite of the die attach surface; attaching to the interposer the semiconductor die having a first surface on which an integrated circuit and at least one electrically conductive bond pad are fabricated, the die having first and second pairs of lateral edges, the strips of compliant adhesive film extending substantially the entire distance between the first pair of opposed lateral edges, the strips each extending substantially less than the distance between the second pair of opposed lateral edges; and bonding the at least one electrically conductive interconnect to the at least one electrically conductive bond pad.

Claim 38 recites a semiconductor device package, comprising a semiconductor die having a first surface on which an integrated circuit and at least one electrically conductive

bond pad are fabricated, the die having first and second pairs of lateral edges; an interposer having a die attach surface and at least one electrically conductive interconnect electrically coupled to at least one bond pad of the semiconductor die, *the interposer being formed of an organic substrate or a polyimide substrate*; and a plurality of strips of compliant adhesive film extending substantially the entire distance between the first pair of opposed lateral edges between the die attach surface and the semiconductor die to adhere the semiconductor die to the die attach surface of the interposer, the strips of compliant adhesive film each extending substantially less than the distance between the second pair of opposed lateral edges.

The package assemblies recited in claims 1, 11 and 38 are patentably distinct from the lead frame assembly taught by Umehara. Umehara does not teach or suggest plurality of adhesive strips attaching a semiconductor die to an organic or polyimide interposer. Rather, Umehara teaches adhering an uncoated semiconductor die to an alloy mounting pad in a lead frame package.

Attached hereto is a marked-up version of the changes made to the claims by the current amendment. The attached page is captioned "Version with Markings to Show Changes Made". All of the claims remaining in the application are now clearly allowable. Favorable consideration and a Notice of Allowance are earnestly solicited.

Respectfully submitted,
DORSEY & WHITNEY LLP



Andrew F. Pratt
Registration No. 48,985

AFP:hap

Enclosures:

Postcard
Check
Fee Transmittal Sheet (+ copy)
Request for Continued Examination (+ copy)

1420 Fifth Avenue, Suite 3400
Seattle, Washington 98101-4010
(206) 903-8800 (telephone)
(206) 903-8820 (fax)

h:\ip\documents\clients\micron technology\100\500182.01\500182.01 amend rce.doc

VERSION WITH MARKINGS TO SHOW CHANGES MADE

In the Claims:

Please amend claims 1, 5-7, 9-11, 17-18, 38-40, and 42 as follows:

1. (Twice Amended) A semiconductor device package, comprising:
a semiconductor die having a first surface on which an integrated circuit and at least one electrically conductive bond pad are fabricated, the die having first and second pairs of opposed lateral edges;

at least one electrically conductive external terminal;

an interposer having a die attach surface and an external surface opposite of the die attach surface disposed in between the semiconductor die and the at least one external terminal, the interposer having at least one electrically conductive interconnect electrically coupling the at least one bond pad of the semiconductor die positioned adjacent to the die attach surface to the at least external terminal positioned adjacent to the external surface, the interposer being formed of an organic substrate or a polyimide substrate; and

a plurality of [pieces] strips of compliant adhesive film extending substantially the entire distance between the first pair of opposed lateral edges disposed in between the semiconductor die and the interposer to adhere the semiconductor die to the die attach surface of the interposer, the strips of compliant adhesive film each extending substantially less than the distance between the second pair of opposed lateral edges.

5. (Twice Amended) The package of claim 1 wherein each of the plurality of [pieces] strips of compliant adhesive film comprises:

a first adhesive layer adhered to the die attach surface of the interposer;

a second adhesive layer adhered to the semiconductor die; and

at least one compliant carrier layer disposed in between the first and second adhesive layers and to which the first and second adhesive layers are adhered.

6. (Twice Amended) The package of claim 1 wherein each of the plurality of [pieces] strips of compliant adhesive film comprises a single layer of elastomer material.

7. (Twice Amended) The package of claim 1 wherein the first surface of the semiconductor die is adhered to the die attach surface of the interposer by the plurality of [pieces] strips of compliant adhesive film.

9. (Twice Amended) The package of claim 1 wherein the plurality of [pieces] strips of compliant adhesive film comprise strips of compliant adhesive film positioned in parallel along a longitude of the semiconductor die.

10. (Twice Amended) The package of claim 1 wherein a first and a second of the plurality of [pieces] strips of compliant adhesive film are positioned at a right angle with respect to each other.

11. (Twice Amended) A device package assembly for a semiconductor die being constructed from a process comprising:

laminating a plurality of [pieces] strips of compliant adhesive film to an interposer having at least one electrically conductive interconnect, the interposer being formed of an organic substrate or a polyimide substrate and further having a die attach surface to which the semiconductor die is attached, and an external surface opposite of the die attach surface;

attaching to the interposer the semiconductor die having a first surface on which an integrated circuit and at least one electrically conductive bond pad are fabricated, the die having first and second pairs of lateral edges, the strips of compliant adhesive film extending substantially the entire distance between the first pair of opposed lateral edges, the strips each extending substantially less than the distance between the second pair of opposed lateral edges;
and

bonding the at least one electrically conductive interconnect to the at least one electrically conductive bond pad.

17. (Twice Amended) The package assembly of claim 11 wherein each of the plurality of [pieces] strips of compliant adhesive film comprises a single layer of elastomer material.

18. (Twice Amended) The package assembly of claim 11 wherein the plurality of [pieces] strips of compliant adhesive film comprise strips of film positioned in parallel along a longitude of the semiconductor die.

38. (Amended) A semiconductor device package, comprising:

a semiconductor die having a first surface on which an integrated circuit and at least one electrically conductive bond pad are fabricated, the die having first and second pairs of lateral edges;

an interposer having a die attach surface and at least one electrically conductive interconnect electrically coupled to at least one bond pad of the semiconductor die, the interposer being formed of an organic substrate or a polyimide substrate; and

a plurality of [pieces] strips of compliant adhesive film extending substantially the entire distance between the first pair of opposed lateral edges [interposed] between the die attach surface and the semiconductor die to adhere the semiconductor die to the die attach surface of the interposer, the strips of compliant adhesive film each extending substantially less than the distance between the second pair of opposed lateral edges.

39. (Amended) The semiconductor device package of claim 38 wherein the [pieces] strips of compliant adhesive film comprise an elastomer material.

40. (Amended) The semiconductor device package of claim 38 wherein the [pieces] strips of compliant adhesive film comprise strips of compliant adhesive material positioned in parallel with a longitude of the semiconductor die.

42. (Twice Amended) A semiconductor device package, comprising:

a semiconductor die having a first surface on which at least one electrically conductive bond pad is fabricated, the die having first and second pairs of lateral edges;

an interposer having a die attach surface and at least one electrically conductive interconnect electrically coupled to at least one bond pad of the semiconductor die, the interposer being formed of an organic substrate or a polyimide substrate; and

a plurality of strips of compliant adhesive film extending substantially the entire distance between the first pair of opposed lateral edges [interposed] between the die attach surface and the semiconductor die to adhere the semiconductor die to the die attach surface of the interposer, the strips of compliant adhesive film each extending substantially less than the distance between the second pair of opposed lateral edges.